DiMES Slot Geometry Analysis

Neil Morley, Mingjiu Ni

ALPS/PFC Meeting

UIUC, May 4th, 2004

HyPerComp, Inc.
Leader in High Performance Computing

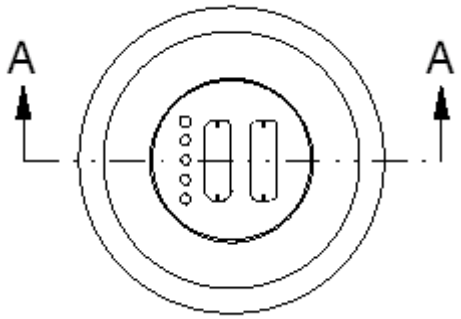
UCLA

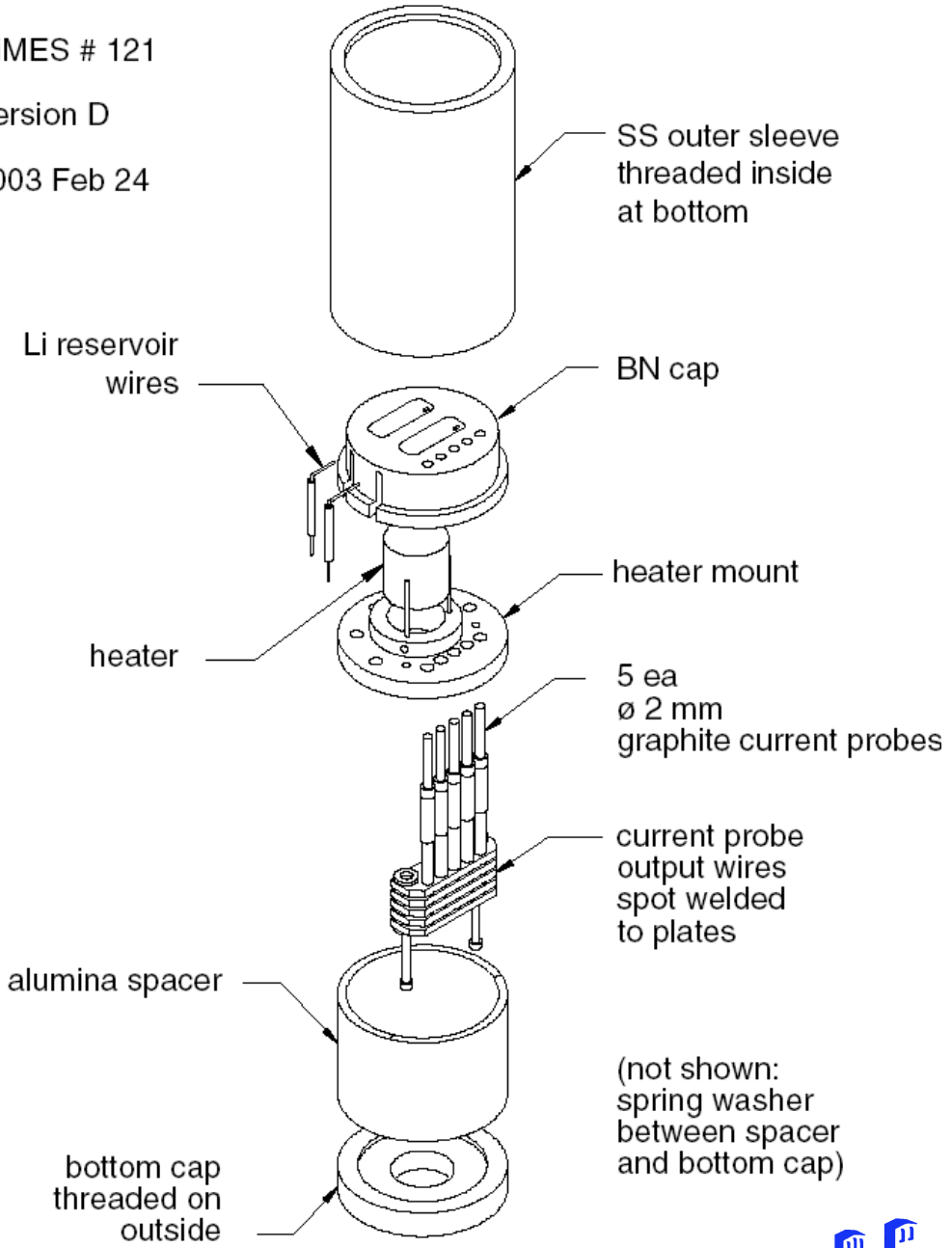
DiMES Slot Geometry Analysi

DiMES # 121

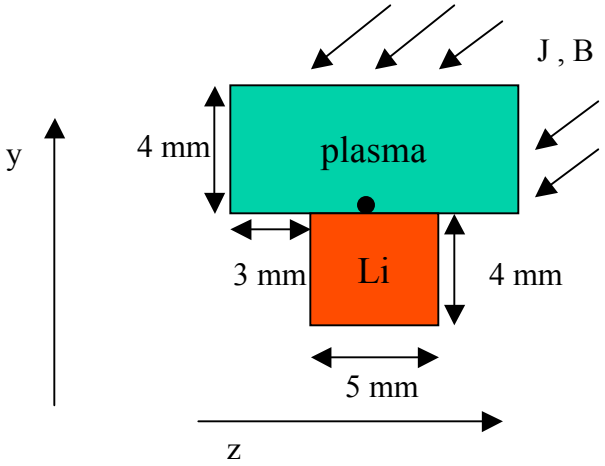
version D

2003 Feb 24

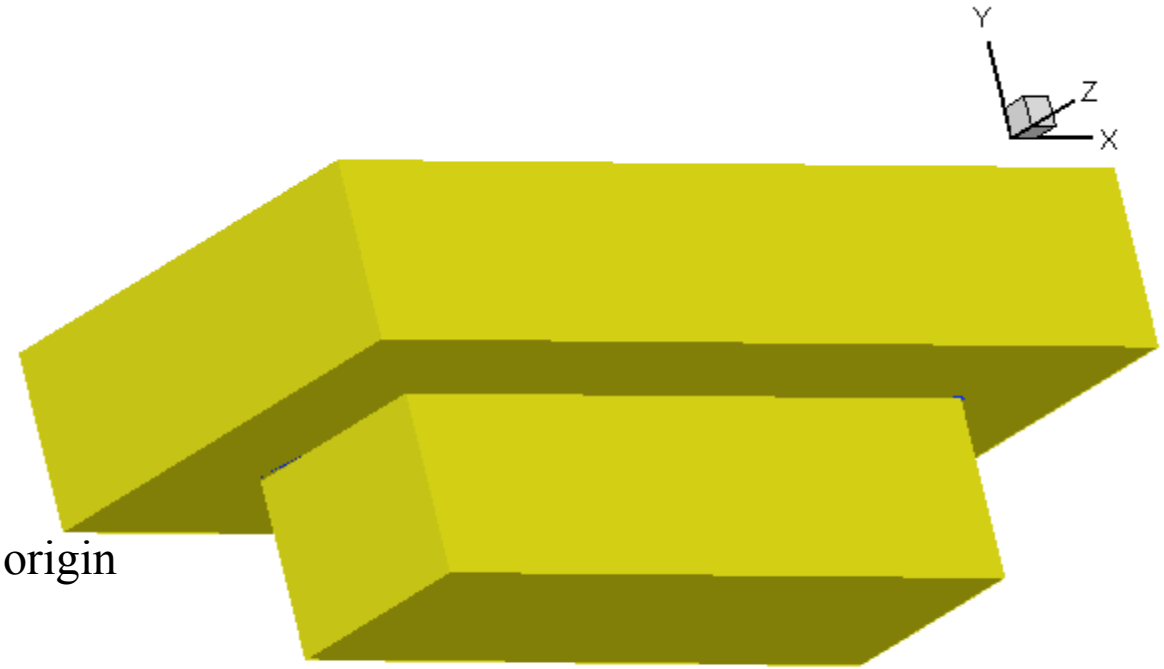




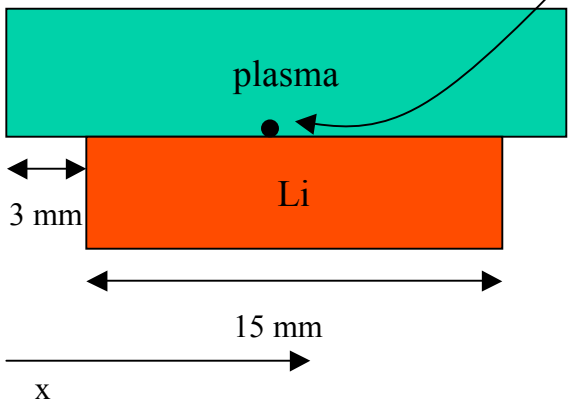
DiMES slot geometry



toroidal-vertical view

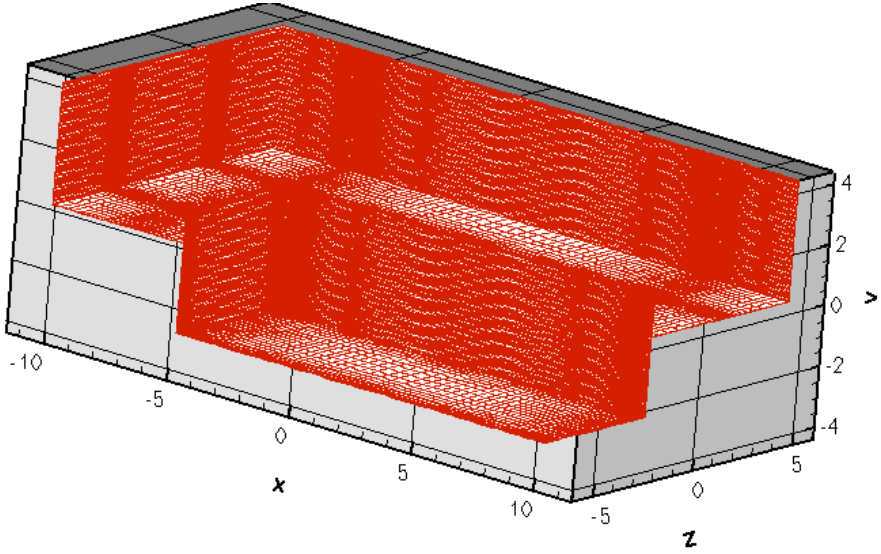


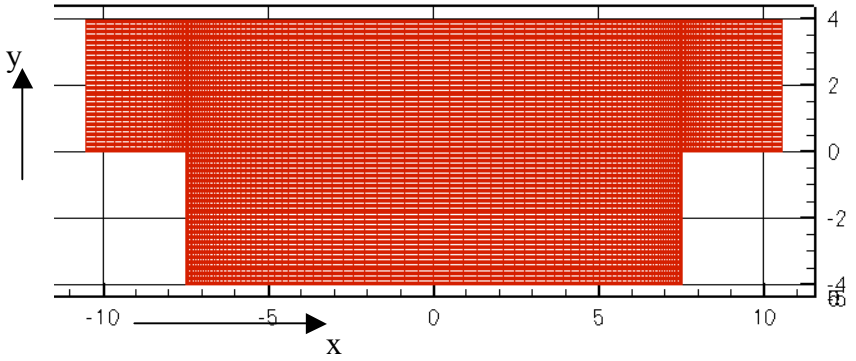
origin

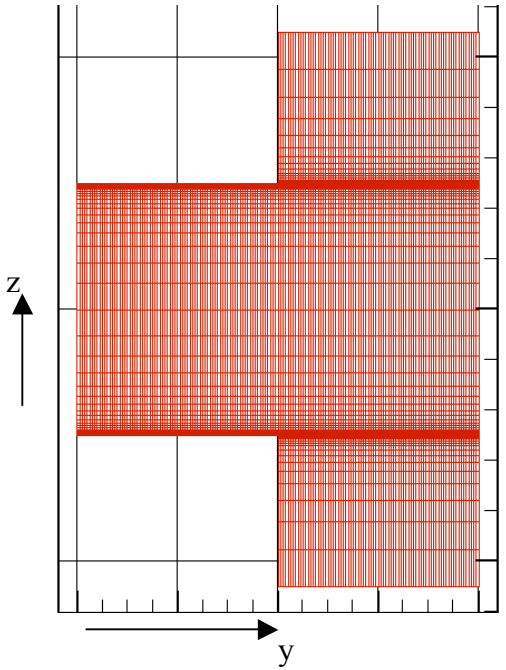


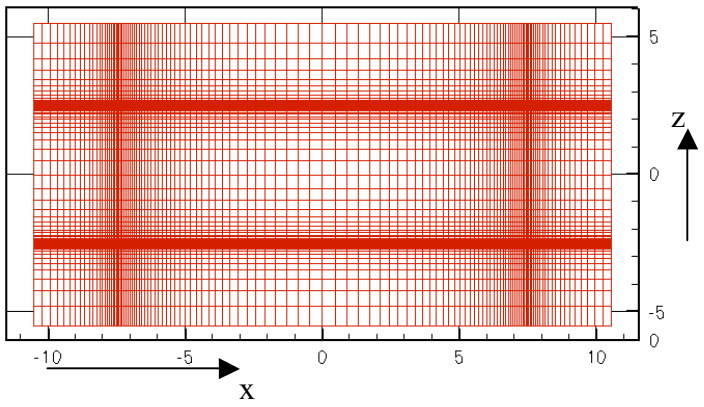
radial-vertical view

Block Mesh – Hartmann Layers Resolved



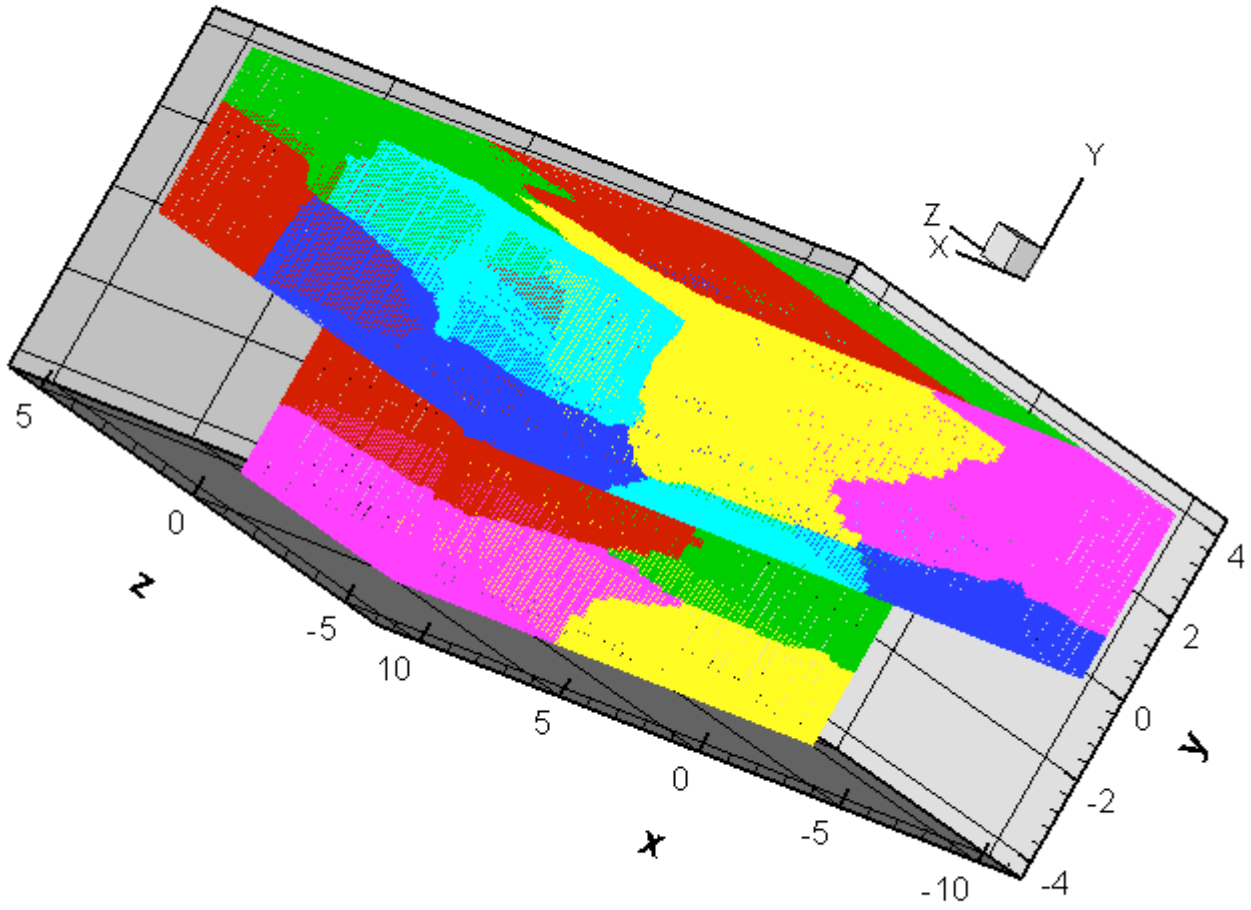




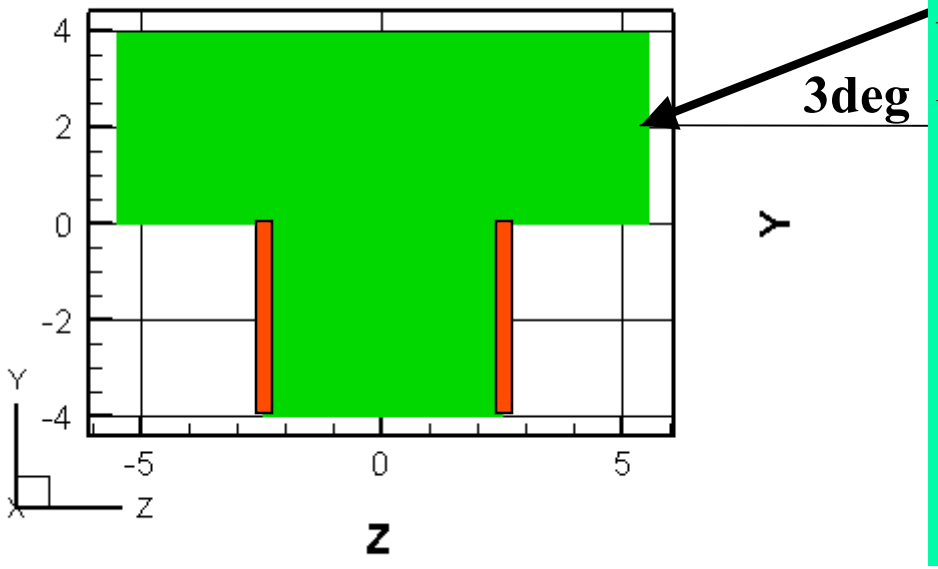


Nodes = 1,222,371
cells = 1,184,000

Mesh and its partition to 16 processors



Case I: Grounding side of slot



$I_0 = 40KA/m^2$

$B_0 = 2T$

Lithium Properties:

$\rho = 485kg/m^3$

$\upsilon = 8.5\times10^{-7} m^2/s$

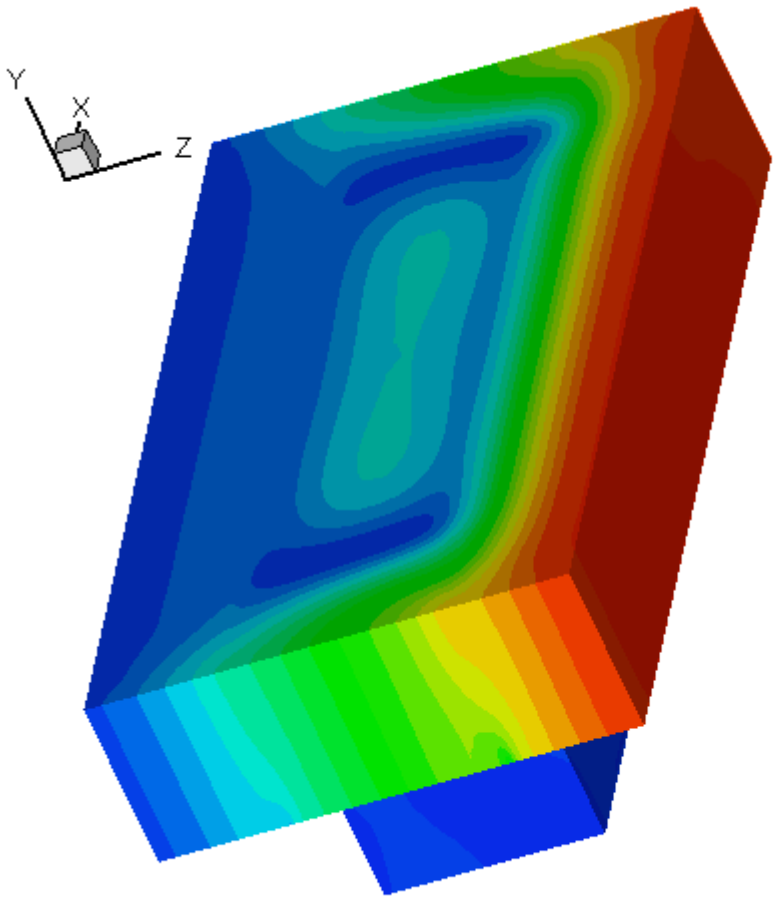
$\sigma = 2.8\times10^6 (mOhm)^{-1}$

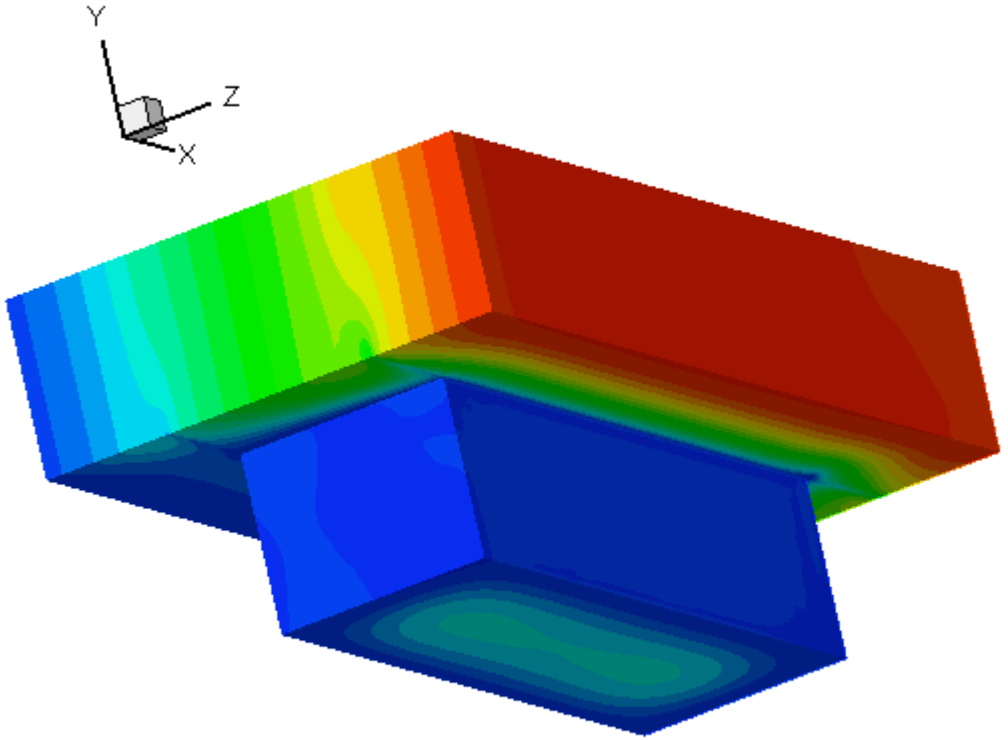
$\sigma_s = 0.35N/m$

- Top and bottom boundaries: insulated wall with $d\phi/dn=0$
- Right top part: applied current boundary condition
- All other boundaries are ground with $\phi = 0$

DiMES Slot

- Side Ground

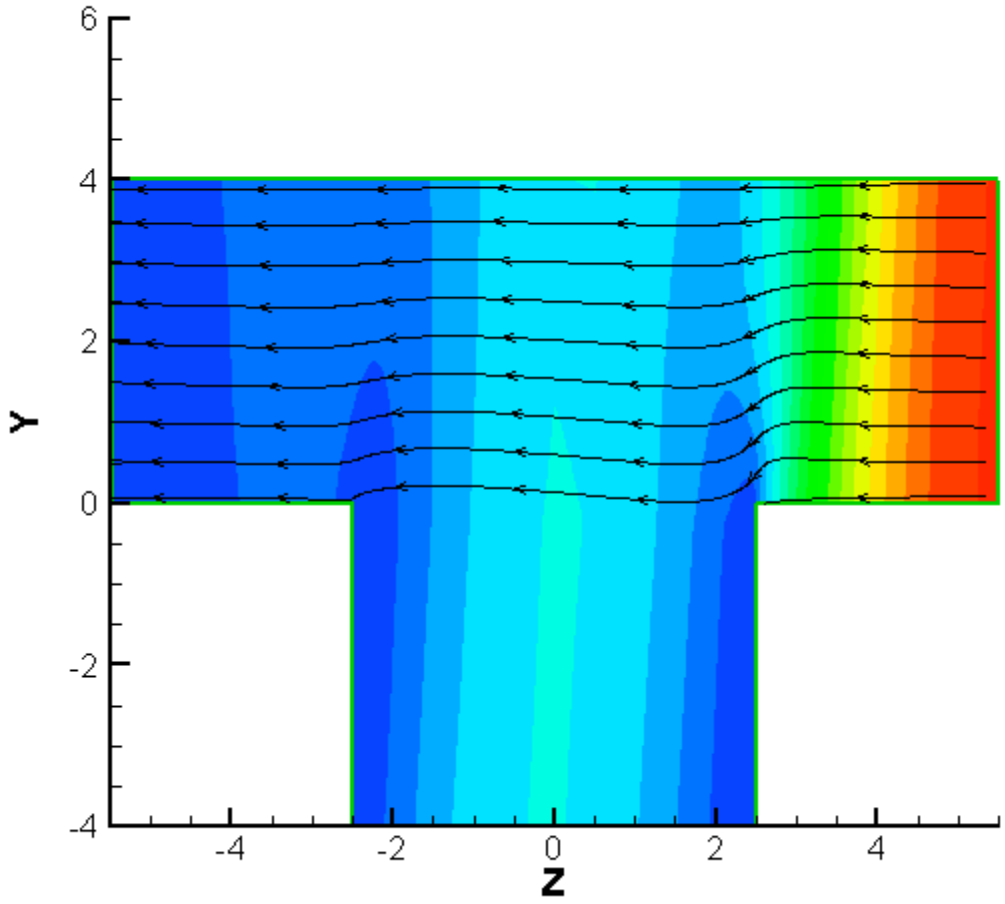




Electrical potential at t=15ms

DiMES Slot

- Side Ground

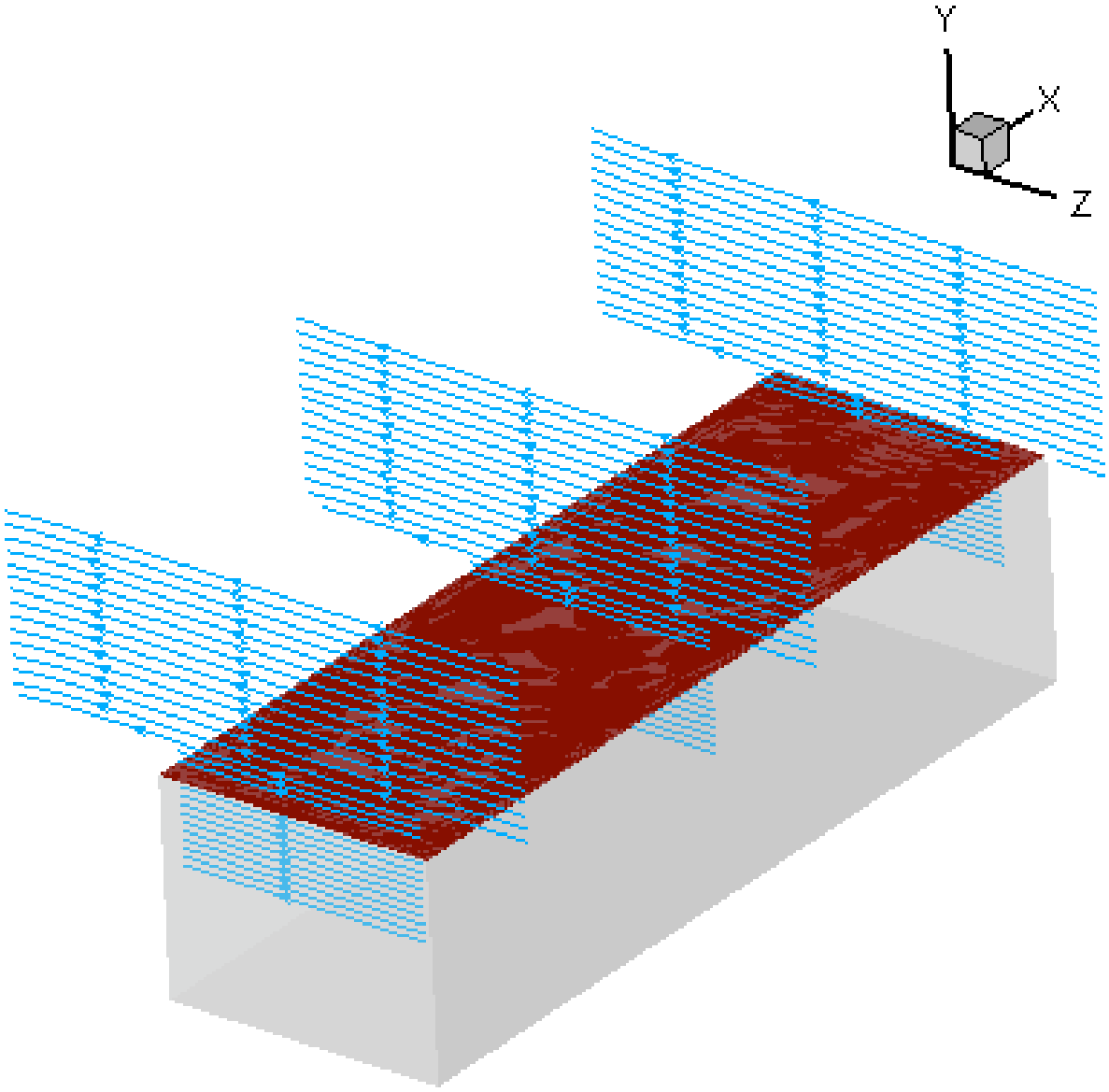


Electrical potential contour and current distribution on the cross section of x=0

DiMES

Slot

- Side Ground
- 0-12 ms



DiMES

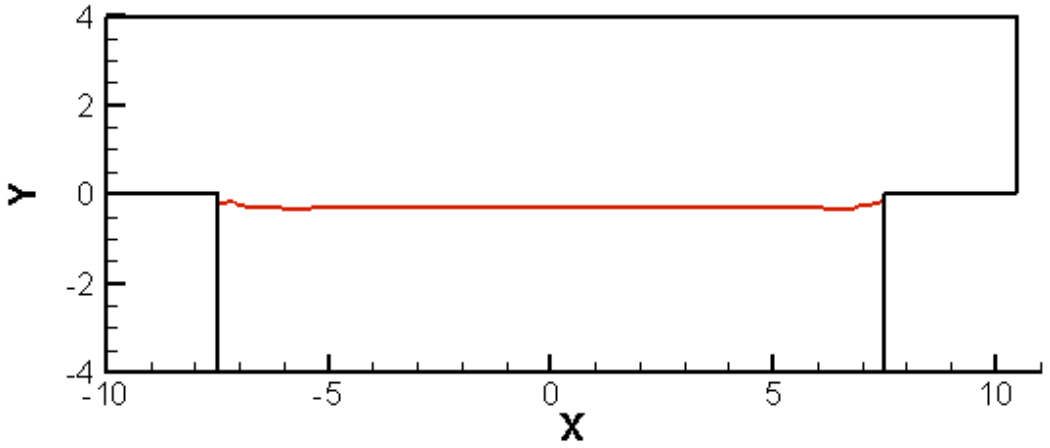
Slot

- Side Ground
- 0-12 ms

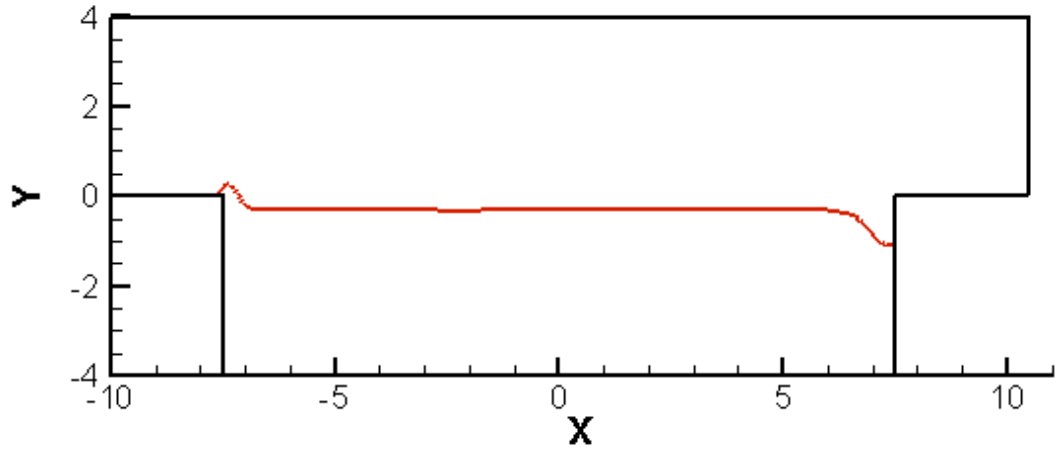
DiMES Slot

- Side Ground

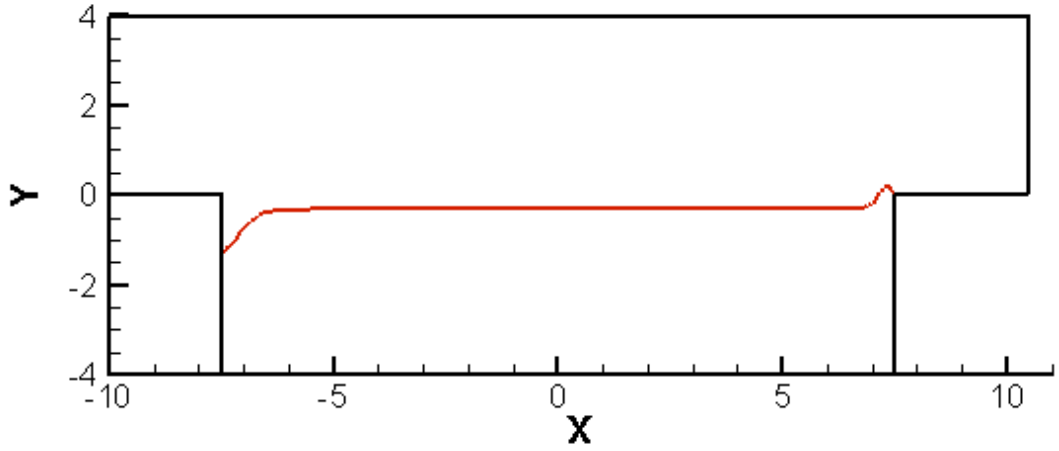
inboard



Z=0



Z=-2

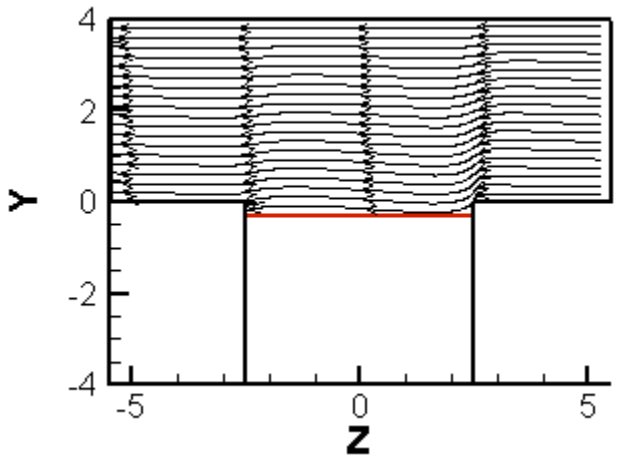


Z=2

DiMES

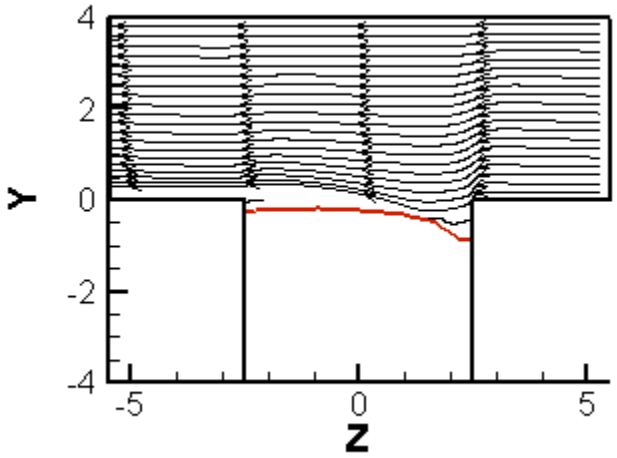
Slot

- Side Ground

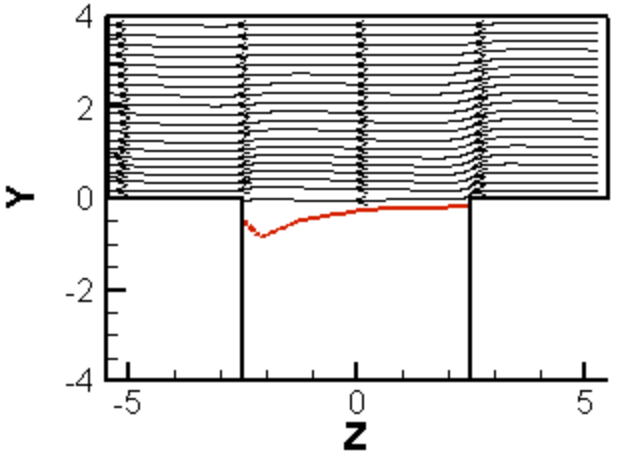


X=0.

Toroidal ←

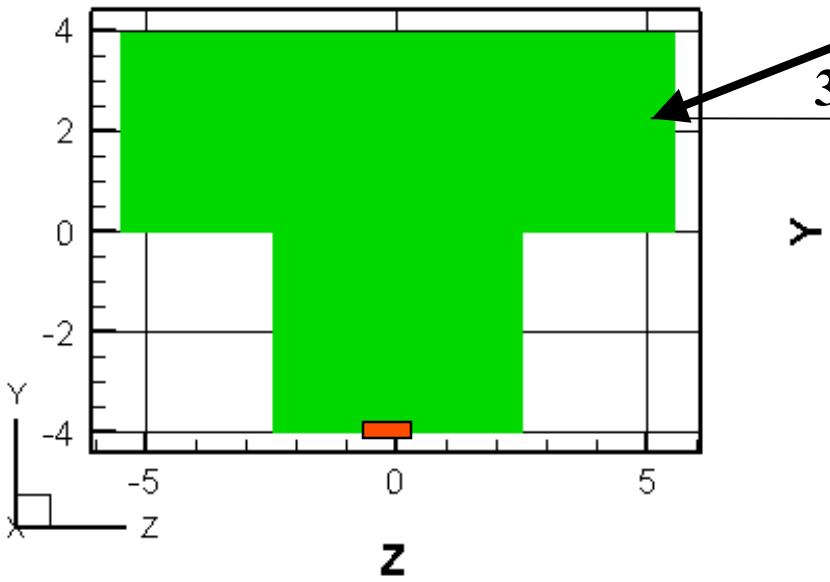


X=-7.



X=7.

Case II with Bottom Grounding



$I_0 = 40KA/m^2$

$B_0 = 2T$

Lithium Properties:

$\rho = 485kg/m^3$

$\upsilon = 8.5\times10^{-7} m^2/s$

$\sigma = 2.8\times10^6 (mOhm)^{-1}$

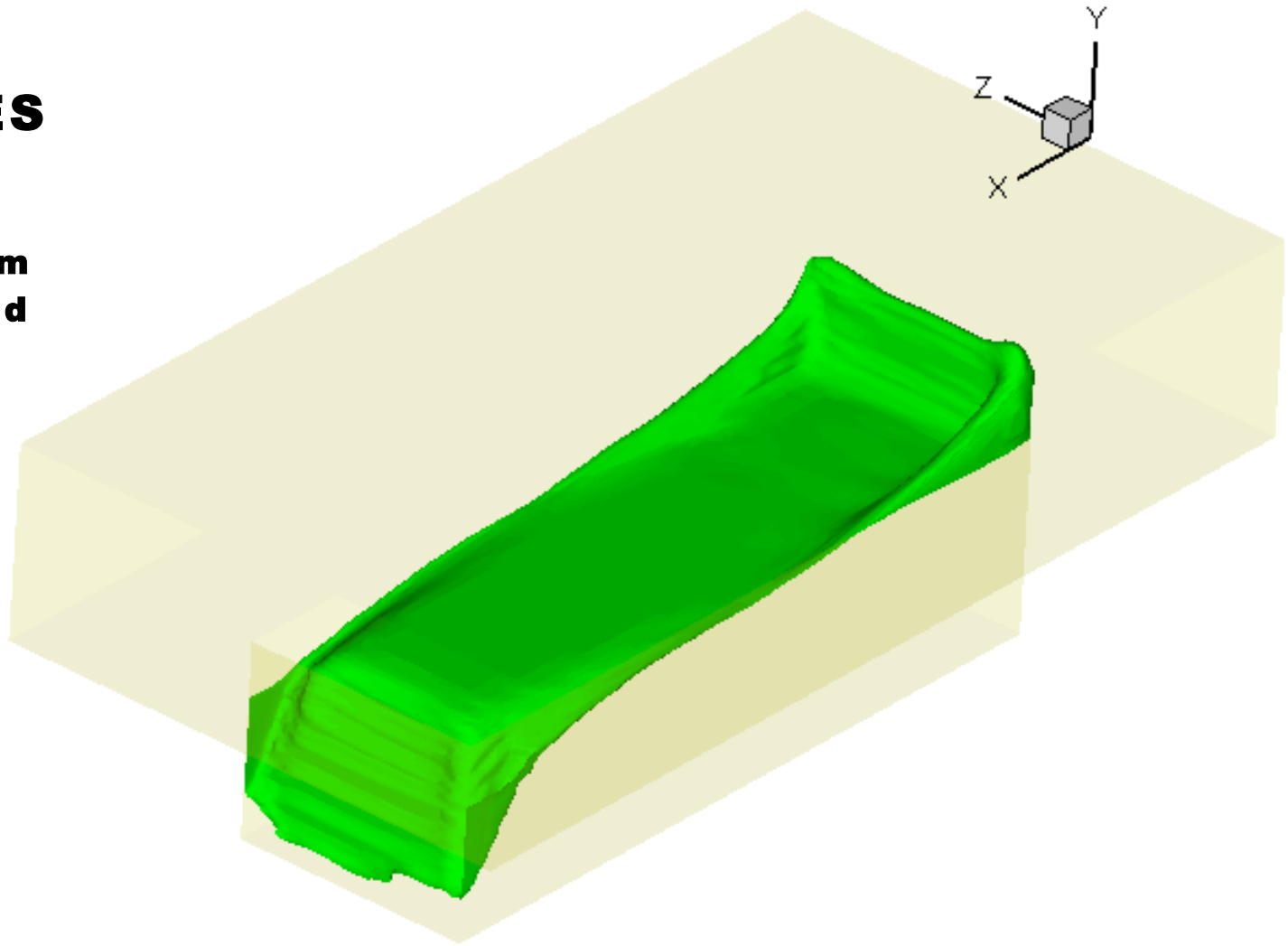
$\sigma_s = 0.35N/m$

- Right top part: applied current boundary condition
- There is a ground patch located at the central of bottom wall parallel to x axis.
- Left top part: zero electrical potential boundary condition $\phi = 0$, and all other parts are insulated wall with $d\phi/dn = 0$

DiMES

Slot

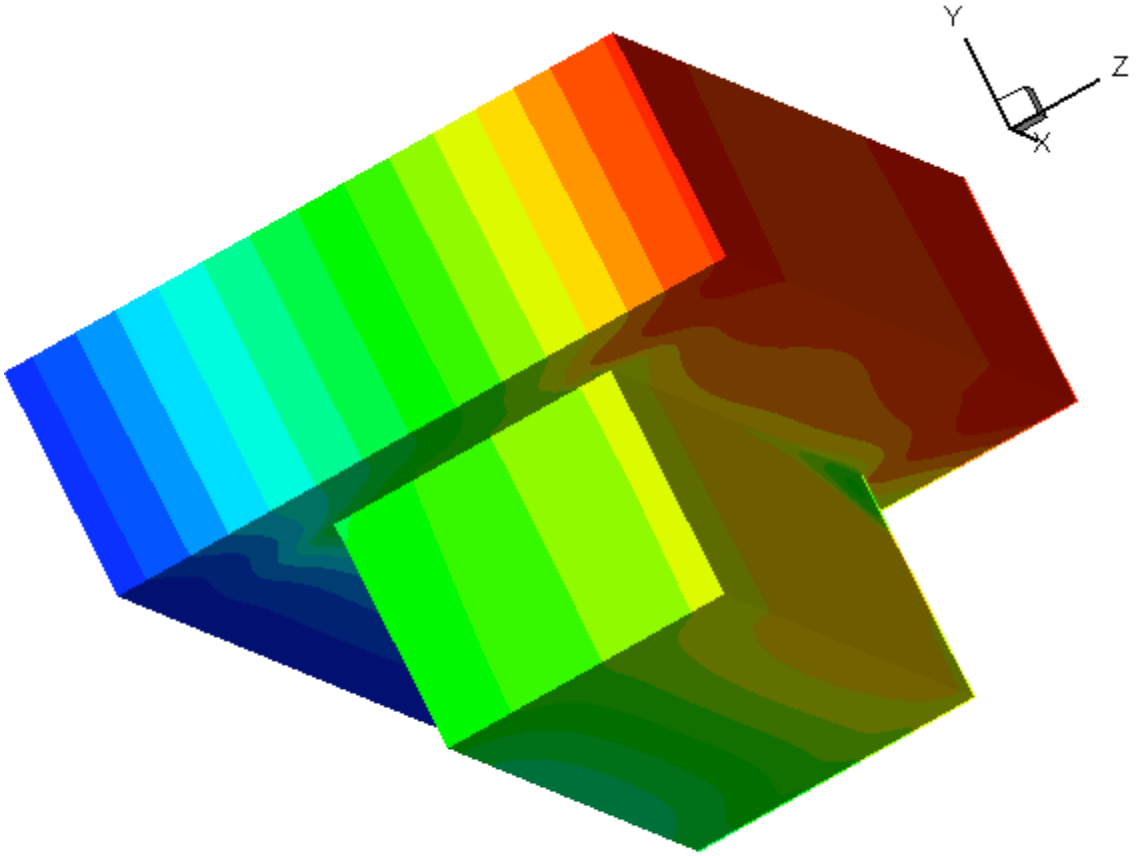
- **Bottom Ground**



Interface shape at t=21ms

DiMES Slot

- Bottom Ground

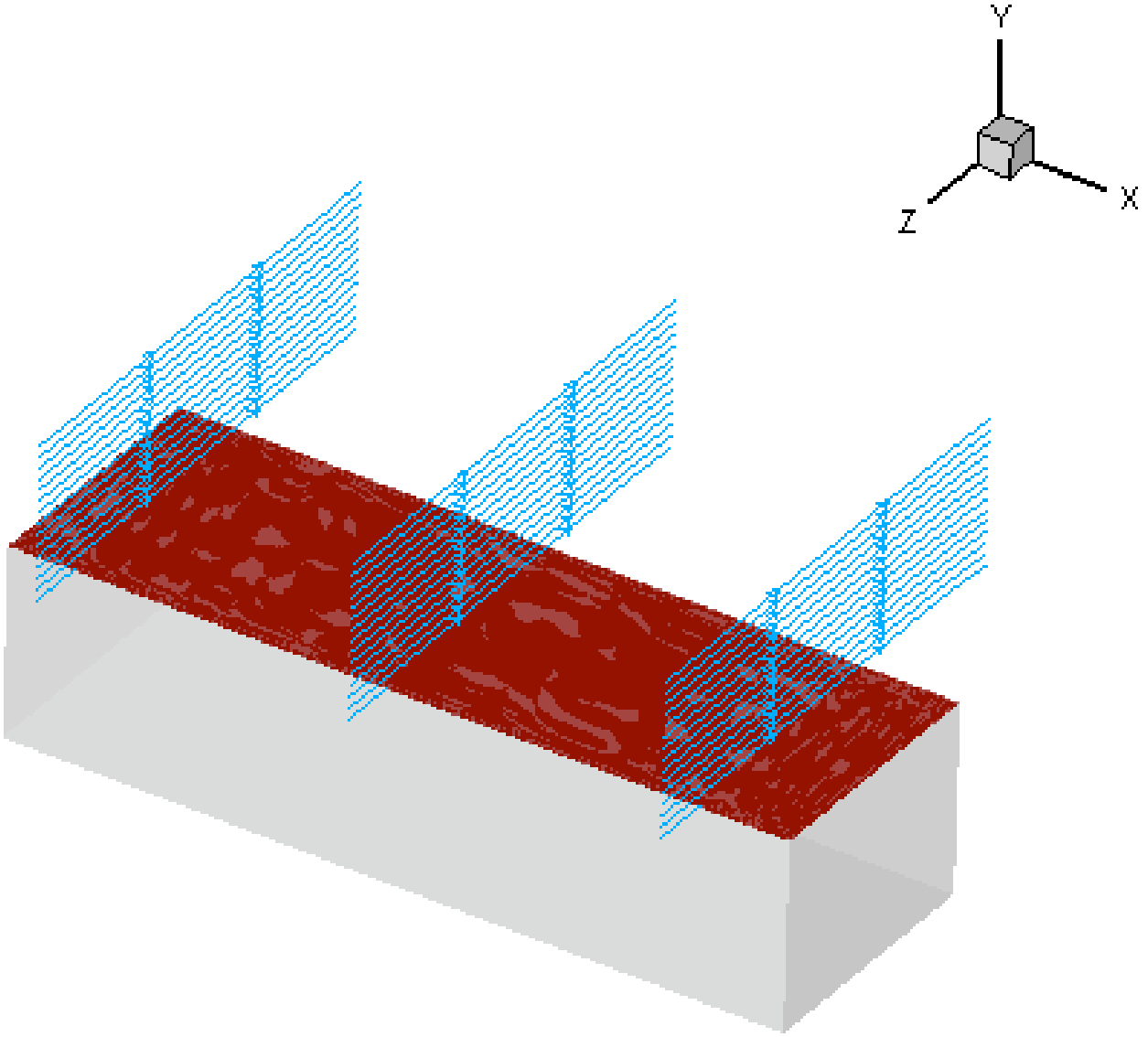


Electrical potential at t=21ms

DiMES

Slot

- Bottom Ground
- 0-21 ms



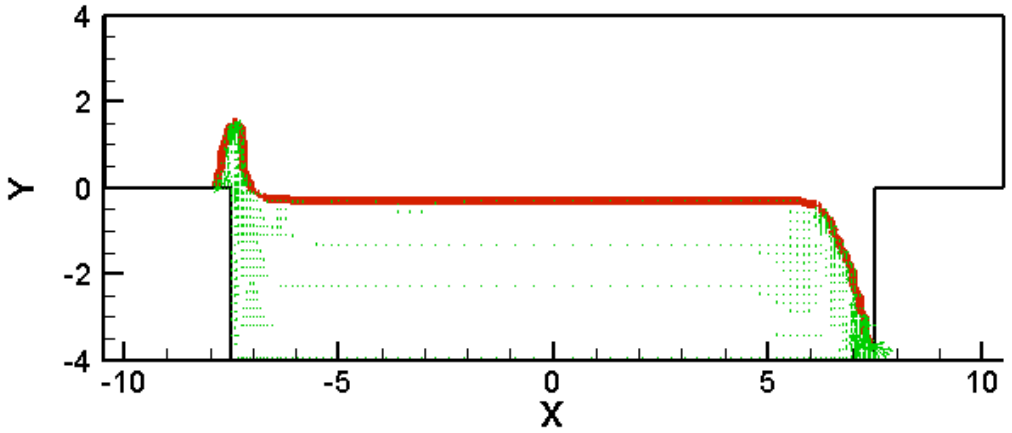
DiMES Slot

- Bottom Ground
- 0-21 ms

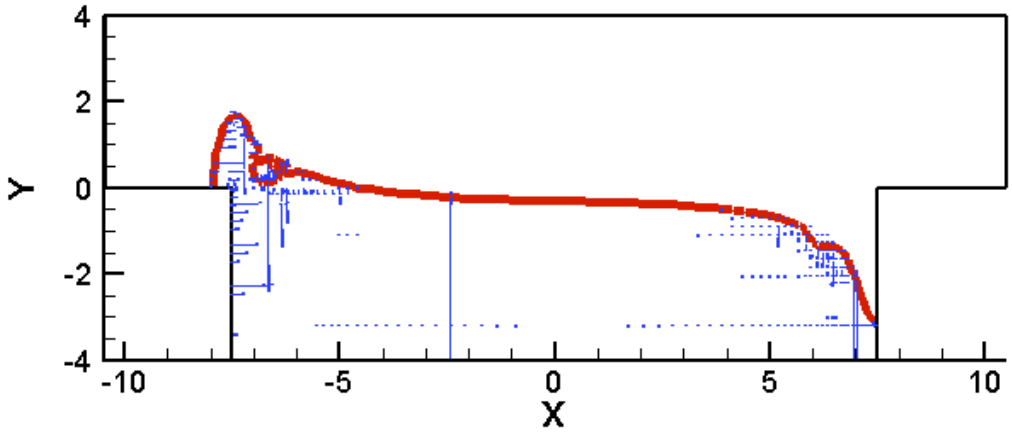
DiMES Slot

- **Bottom Ground**

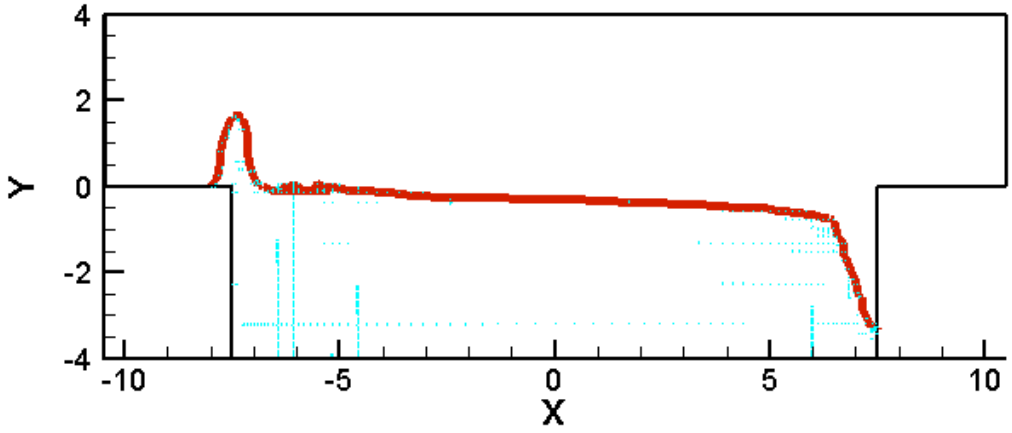
inboard ←



Z=0



Z=-2



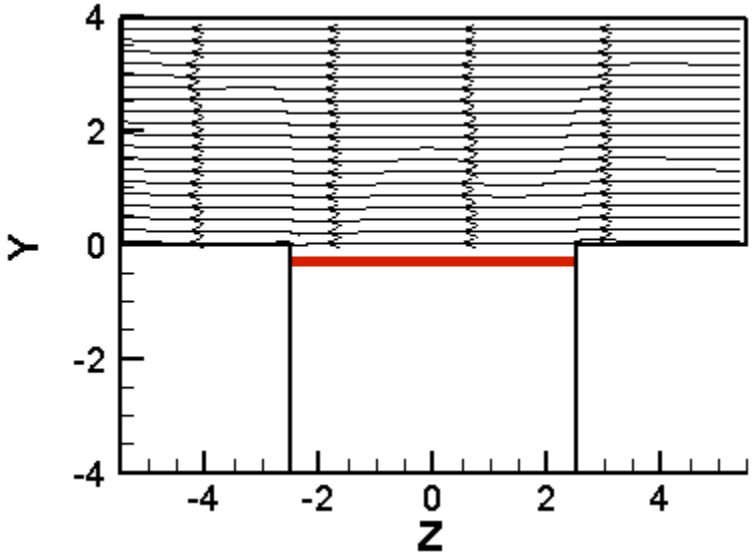
Z=2

UCLA

DiMES

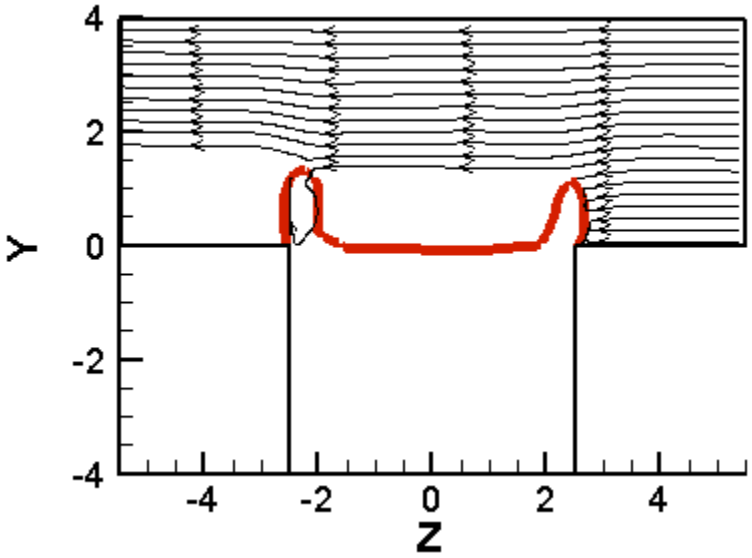
Slot

- **Bottom Ground**

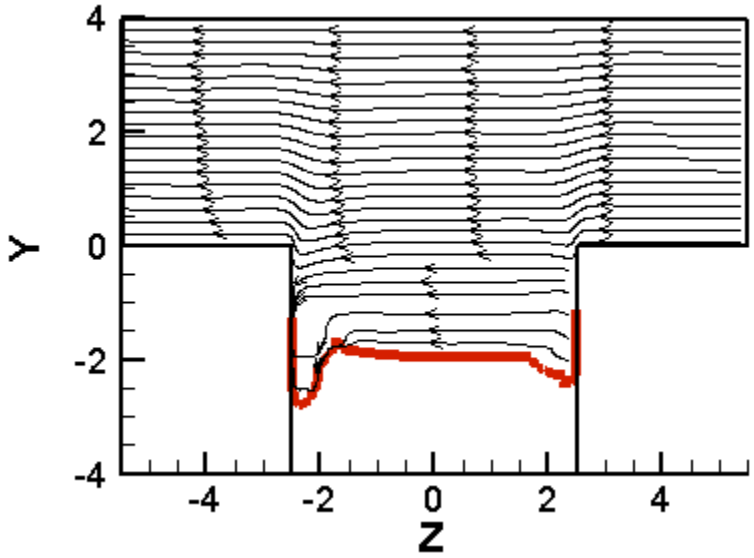


X=0.

toroidal ←



X=-7.



X=7.